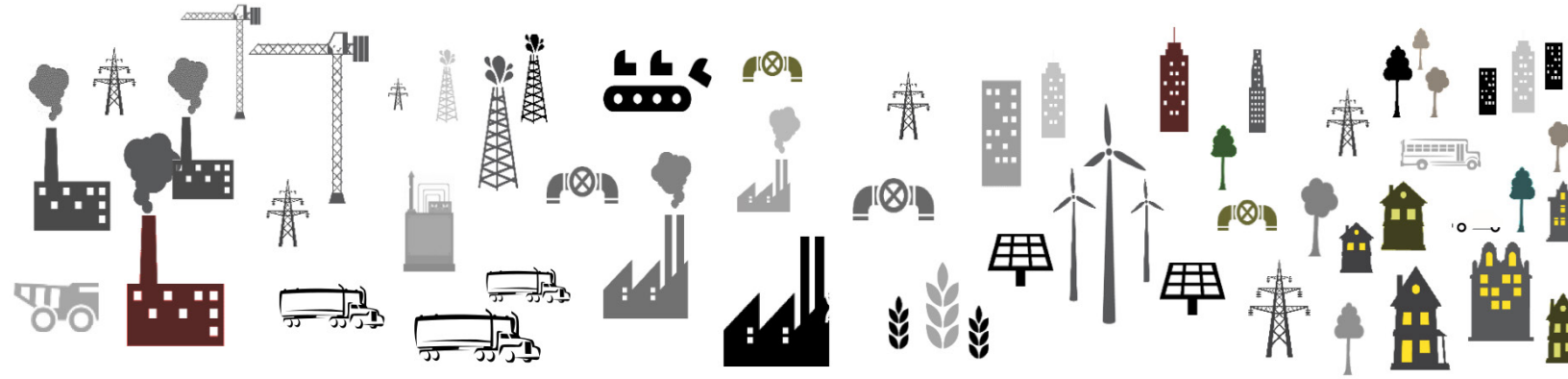
A Journey from Historian to Infrastructure



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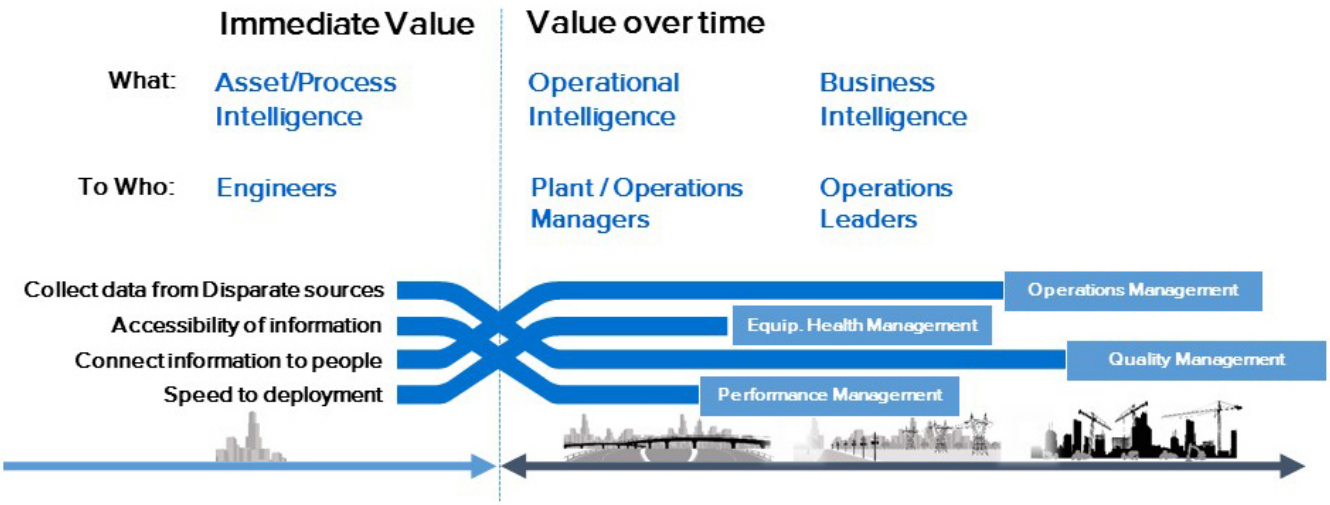
Summary

As technology lowers barriers to large scale data capture, industries are searching for ways to capitalize on information; however, very few have standardized technologies that allow data to create impact at an enterprise scale. More often, operational ecosystems encompass single purpose technologies, such as traditional historians, that limit exposing information to multiple people or purposes. While invaluable for local visibility, implementing numerous single purpose technologies across the enterprise leads to multiple versions of the truth, information islands and layers of legacy systems. In this environment, people often struggle to access, analyze or share data especially outside organizational, geographical or security boundaries. Data remains underutilized or "dark" for key business drivers such as asset health, process efficiency and quality.

To scale the impact of data, leaders need to adopt technologies that not only store large volumes of data but create a data management system that supports ease of access, provides operational context and makes data available to multiple users and systems. This **data infrastructure** protects, shapes and validates critical data and also supports collaboration around a common body of information to reduce overall costs while increasing overall efficiency, performance and quality.

As barriers to capturing sensor-based data continue to fall, it's time to consider how technology delivers opportunities for continuous improvement and enterprise performance. OSIsoft's PI System™ capabilities have evolved beyond those that define traditional historian software. This note explains why and how PI System can be leveraged as an infrastructure to support business transformations.

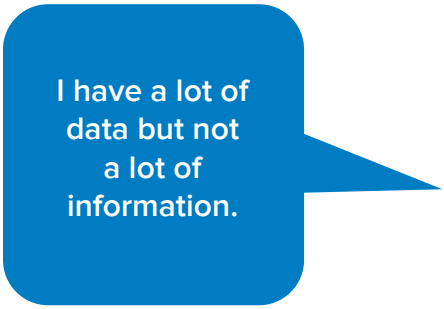


An OSIsoft infrastructure delivers immediate value through real-time data and visibility. Over time, the value of data extends past local visibility. Engineers, Managers and Business leaders draw from a unified data layer to connect assets, systems and sites to support overall enterprise performance.

Current Challenges

Since the 1980's, traditional historians have been a central part of an operational ecosystem. They are highly efficient at capturing and storing large volumes of granular data and provide visibility into operational process, performance and efficiency. Although traditional historians are extremely cost-effective systems of record, they have been incrementally deployed asset by asset, system by system and site by site in response to pre-defined needs. While this approach delivers localized value, it complicates overall data governance and poses barriers to creating enterprise-wide intelligence.

Information trapped in single purpose systems - Traditional historians are often used to support initiatives with defined scopes and timelines. This approach creates information silos, multiple versions of the truth and disparate data at site and enterprise levels. Data records can be hard to decipher, fragmented or incomplete when using data to impact process efficiency, asset health, regulatory reporting or quality.



Lack of context - Traditional historians typically have only basic context layers which can be vendor or control system specific. Typically, only a few initial users responsible for control system naming convention can fully benefit from the value built into the semantic namespace. Others spend valuable time trying to find and integrate the "right" operational data for analysis, roll ups. As a result, operational data often remain "dark" – untouched, underutilized or forgotten.

Data access - Information and context layers stored in traditional historians do not propagate across defined security, physical and logical boundaries. Limited access means that it can be difficult or impossible to use data outside of immediate work spaces. Comparing site-to-site performance or identifying systematic bad actors are prime examples.

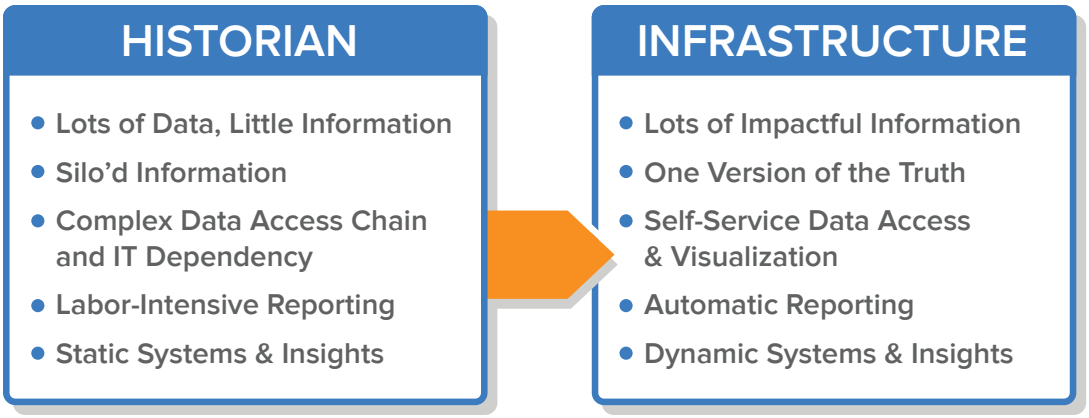
Risk - Most industries today self-describe as facing a "Silver Tsunami." Critical knowledge is at risk as individuals with deep experience move closer to retirement. Legacy systems designed to support local information needs compound the issue by facilitating knowledge transfer only within a small, localized community. Local knowledge bases support "colloquial" operating procedures and create difficulty aligning operations with organizational objectives. As the Internet of Things (IoT) offers opportunity, many legacy systems will not scale to realize the benefits these newer intelligent devices present.

The Journey from Historian to Infrastructure

When addressing enterprise performance, organizations can realize the full potential of data when larger groups strategically assess systems, identify information gaps and take action. Their success depends on the ability to harness data to connect people, processes and information.

Like historians, data infrastructures connect to diverse operational assets and store large volumes of operational data. They also detect anomalies, sense variance in operating procedures and use logic to trigger targeted actions; however, an infrastructure extends the impact of information beyond local environments by:

- **Creating a universal, master data system**. An infrastructure simplifies governance so important data can be formally managed. It also supports processes that democratize data so people in any organizational department or at any level have real-time access to data and information.
- **Removing the work associated with finding, converting and organizing data**. People no longer have to wrestle with complex data access chains to find the "right" data for analysis or reporting.
- **Making data available for multiple purposes**. Instead of being used for preordained purposes, data can be accessed and shared with people and systems to support systematic enterprise control and communication throughout its parts.
- **Reducing overall complexity and cost**. An infrastructure eliminates the skilled resources, customized solutions and coding associated with connecting data from isolated point solutions, applications and historians.
- **Creating enterprise readiness**. Enterprises can rapidly take advantage of advances in IT applications, technology and solutions without having to re-integrate or rip and replace enterprise operational technologies (OT) architectures.



Three Essentials of a Data Infrastructure Approach

As connected devices and increased connectivity lower the barriers to capturing even more data, enterprises need tools that scale to meet enterprise needs. An infrastructure builds on traditional historian capabilities by enhancing:

1. Data in Context

2. Information Availability

3. System Readiness

1. Data in Context

Operational technologies generally lack overarching semantic structure to support ease of data access and use. Even now, operational data stored in traditional historians often remain "dark" or underutilized, reducing its impact on asset health, quality and process efficiency. An infrastructure facilitates data access and use in two principal ways.

I. Organizing data streams, including time series, unstructured and relational data, to correspond to asset topology.

Through scalable yet configurable metadata layers, asset models organize data streams according familiar, physical objects, such as transformers, pumps, motors, etc. Once a basic asset framework has been defined, users can:

- **Create asset templates** including hierarchies of associated elements, attributes, notifications, calculations and events.
- Group and regroup assets, without limits, to **drive meaningful analysis** and innovation
- Create connectivity models to monitor process flow between assets.
- Embed calculations that are **automatically performed** in real-time on both incoming data streams and archived data.
- **Incorporate important information** such as nameplate, age, manual data entries and other classification data into templates.

EXAMPLE:

Users across an organization can easily access data to link aperational parameters, such as abnormal vibrations or temperatures, to multiple business impacts even if specific asset or factor is not within their defined workspace.

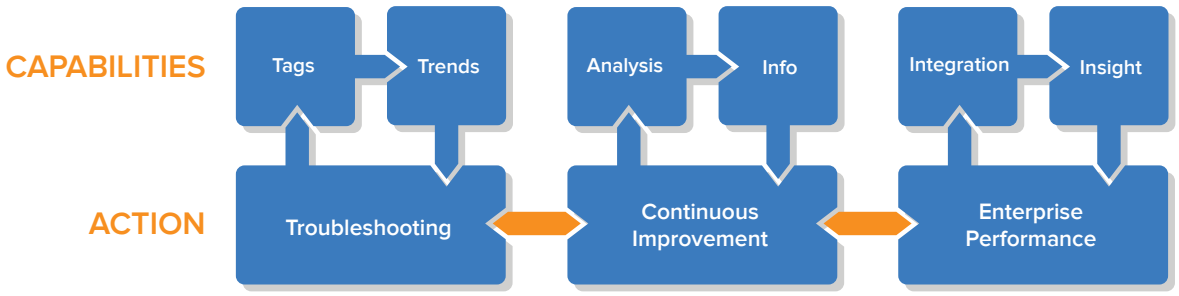
A data infrastructure augments understanding of data streams within a larger operational context and supports governance by federating data naming conventions and associated context. When data names are attached to operational context, enterprises are no longer dependent on a cast of non-replaceable individuals to translate one-of-a-kind naming conventions. Asset templates and hierarchies also support knowledge transfer across time and sites. Calculations and predictive information can be embedded back into the infrastructure and propagated to each instance of the element to support continuous improvement and enterprise commonality while saving time and costs associated with updating overall semantic structure.

II. Incorporate bookmarking functions that easily link process data to pertinent events or identified timeframes.

Important events such as equipment downtime, process excursions, startup and shutdown sequences, product batches and operator shifts have significant business impacts; however, it is challenging to link ongoing process data to discrete, specific events to uncover root causes, process efficiencies or map costs. Bookmarking functions enable users to:

- **Define pertinent event types** and standardize their organization in relation to assets and data sources.
- **Parse multiple data streams** with a discrete event to compare contributing factors or impacts against other similar instances.
- **Create start and end times** for intervals associated with batches, shifts or run times and link to time series data.

Overall, highly developed context layers allow users to easily identify data needed to support continuous improvement, accommodate enterprise commonality without compromising the ability to serve unique site needs.



2. Information Availability

Seamless connectivity between traditional historians typically falls apart at the network layer due to either an inability to create secure connections, protocol or compatibility issues. It can be difficult for users to collaborate or leverage data from different parts of the enterprise. Data transferred from one system to another fails to make sense at its destination due to inconsistent formatting, lack of context, different resolutions, etc. A data infrastructure approach:

- **Delivers data on demand** by making data and information available on multiple devices at an asset's location, centralized control centers and outside traditional enterprise walls. Enterprises can scale and improve domain expertise by delivering information where, when and how it is needed.
- **Creates a single version of the truth** to create consistency around enterprise KPIs, enable performance comparisons, drive adoption of common processes and measure the efficacy of solutions.
- **Connects users to broader data landscape** so users can compare and contrast information across more operational sources. Expanding data instances across sites creates sharper insights and increases confidence in decisions.

Better information availability creates synergies across departments, sites and organizational levels, ultimately to recover costs by improving how decisions affect all parts of the enterprise. With enhanced context and availability, management teams can use data for multiple purposes to understand how decisions affect overall enterprise costs, efficiency and quality instead of confining information to serve local needs.

EXAMPLE:

In an enterprise with three similar sites, a user developing a leading indicator to predict asset failure could create deeper event correlation by leveraging data from similar assets at all three sites.

3. System Readiness

Leveraging data on a constant basis is key to operational agility needed to support continuous improvement, innovation and enterprise resilience. When data is locked in fixed taxonomies or captured for preordained purposes, people, systems and processes can become rigid, leading to certain obsolescence. Developed on platform neutral technologies, an open infrastructure is developed to be source and industry agnostic and work as part of an overall IT structure that evolves as technology, assets and KPIs change. With an infrastructure, industries can:

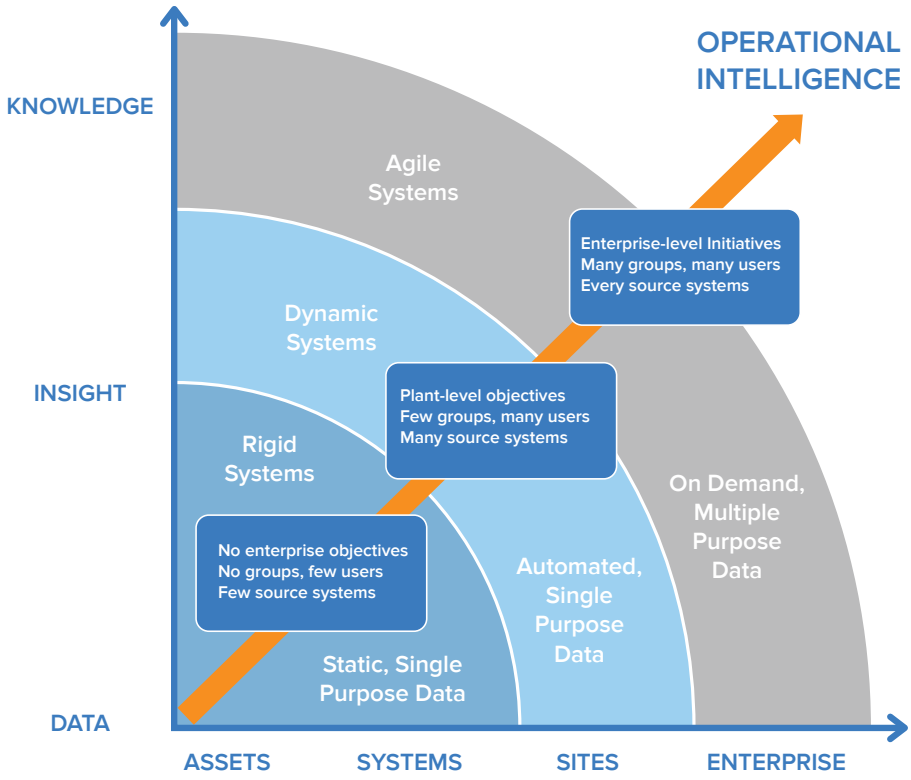
- **Leverage advances in IT applications** and solutions without having to re-integrate or rip and replace enterprise operational technology (OT) architectures.
- **Accommodate changes** in asset base, processes or even business structures such as acquisitions and mergers.
- **Simplify the integration and architecture of OT and IT systems** by deploying a common software layer between OT automation systems and business applications.
- **Offer self-service tools** to empower users to build task- or role-specific displays and reports using easy-to-configure, out-of-the-box tools. Adaptable tools can embed (insight/calculations) as well as reduce custom coding and 3rd-party application costs.

As opposed to single purpose applications, an infrastructure protects all mission critical data, historical and real-time. This data serves as the basis for forensic analyses, optimization and creating predictive information to reduce overall operational variability. Finally, as an open infrastructure, the infrastructure works with applications and other enterprise software systems to drive innovation or respond to outside change without disrupting core operations.

An Infrastructure to Drive Operational Excellence

For over 25 years, the PI System has captured, delivered and stored real-time data for key initiatives such as equipment availability, process efficiency and safety. OSIsoft's PI System capabilities have grown to exceed those that define traditional historian software to expand the impact of information beyond local environments.

With its roots in historian technologies, the PI System still performs the fundamental task of a historian as a system of record to capture and protect vital data. Evolution to a data infrastructure now means that the PI System supports a centralized environment to share "one version of the truth" for sensor-based and related business data.



A Data Infrastructure:

1. Enables real-time, self-service access to enterprise data
2. Delivers data and information to multiple users, for multiple purposes
3. Provides connections to hundreds of data sources
4. Includes a context framework to turn data into enterprise ready information
5. Ensures readiness for today's and tomorrow's time series data sources, business models and technological advances

The OSIsoft Vision

With the belief that people can transform their world if they have access to the data they need, OSIsoft created the PI System as a common data infrastructure to capture and store real-time data and make it available for visualization and analysis. For over 30 years, OSIsoft has delivered the PI System with the singular goal of connecting people around the enterprise with data and systems. Today, the PI System is embedded in operations and critical infrastructure in over 125 countries. Sixty-five percent of the Global 500 process companies use the PI System to help transform operations. Our customer base includes Fortune 100 and Fortune 500 companies in power generation, oil and gas, utilities, metals and mining, transportation, critical facilities and other industries. OSIsoft remains faithful to its original mission – to push the edges of innovation and create software that brings high fidelity data from disparate sources to people in all corners of our customers' enterprises – wherever, whenever and however it is needed. To see any of the 1100+ customer success stories, product descriptions or global initiatives, please visit www.osisoft.com.